

Relationship between CGOL (Chlorophyll, Ginger, Orange, and Lemongrass) consumption and confirmed COVID-19 cases on pregnant women

Diyan Indriyani,^{1,2} Esti Yunitasari,³ Ferry Efendi³

¹Doctoral Nursing Program, Faculty of Nursing, Universitas Airlangga, Surabaya; ²Faculty of Health Sciences, Universitas Muhammadiyah Jember, Jember; ³Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

Abstract

Nutritional status and health are crucial factors in maintaining a healthy pregnancy, especially during the COVID-19 pandemic.

Correspondence: Diyan Indriyani, Doctoral Nursing Program, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia.
E-mail: diyanindriyani@unmuhjember.ac.id

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This study aimed to analyze the relationship between CGOL (Chlorophyll, Ginger, Orange, and Lemongrass) consumption and confirmed COVID-19 cases in pregnant women. The research, conducted in East Java with 250 purposively sampled respondents, employed a correlational cross-sectional design. Data were collected through questionnaires, Likert scales, and documentation. Analysis of research data using descriptive analysis and Spearman-Rho analyses. The study revealed that CGOL consumption in pregnant women was 28% less than optimal, 21.2% moderate and 50.8% optimal. Confirmed COVID-19 cases in pregnant women are 10%, and 90% are not confirmed. There was a significant relationship between CGOL consumption and confirmation of COVID-19 in pregnant women ($p=0.0001$). These findings emphasize the importance of integrating CGOL-based nutritional guidelines into prenatal care programs, particularly during pandemics, to enhance pregnant women's and their babies' health.

Introduction

Pregnancy is a significant event for both pregnant women and their partners,¹ representing a period of maturation amidst potential crises.² Physiological changes during pregnancy lead to a decrease in immunity,³ necessitating various measures to safeguard the health of expectant mothers.^{4,5} The global occurrence of COVID-19, including Indonesia, has presented a critical issue, as there is currently no specific cure for this virus.⁶ Thus, it is imperative to adopt preventive measures against COVID-19 exposure and infection.⁷ These preventive measures include physical distancing,⁸ frequent handwashing,⁹ optimizing nutrition through a balanced diet,¹⁰ and the supplementation of essential nutrients to enhance immunity.^{11,12} Based on health service data from confirmed COVID-19 cases, it is evident that certain demographics, such as the elderly, toddlers, individuals with comorbidities, and pregnant women, are at a higher risk for adverse outcomes.¹³

Certain nutrients are believed to have immunity-boosting properties, such as foods rich in chlorophyll,¹⁴ essential ingredients from spices like ginger and lemongrass,^{13,15} as well as fruits abundant in vitamin C, such as oranges.^{11,16} However, no studies have investigated whether the consumption of these ingredients effectively enhances immunity in pregnant women, particularly in preventing COVID-19 exposure. Indonesia reported its first two positive cases of COVID-19 on March 2, 2020. By April 15, 2020, the virus had spread to all 34 provinces.¹⁷ Jember Regency in East Java, which reported one of the highest Maternal Mortality Rates (MMR) in the province and ranked second in Infant Mortality Rate (IMR), was significantly affected.¹⁸ In 2020, there were 645 reported cases of COVID-19 in pregnant women in Indonesia by September 11, 2020.¹⁹ Given these circumstances, it is essential to optimize promotive and preventive actions to mitigate the risk of COVID-19

complications during pregnancy. While previous research has investigated the nutritional content of chlorophyll,¹⁴ ginger, oranges,¹³ and lemongrass,¹¹ no studies have explored whether the consumption of these nutrients, particularly among pregnant women, can effectively prevent COVID-19 exposure. The aim of this study was to analyzing relationship between CGOL consumption and confirmed COVID-19 cases on pregnant women.

Materials and Methods

Research design

A correlational design with a cross-sectional, retrospective study approach was employed, with the research aim of analyzing relationship between CGOL consumption and confirmed COVID-19 cases on pregnant women.

Study participants

The study population consisted of pregnant women who received antenatal care at the hospital in East Java in 2020, there were five hospitals as research locations located in East Java province. Researchers determined the sample size 250 samples using purposive sampling techniques from January to July 2021. The inclusion criteria comprised pregnant women who received antenatal care at an East Java hospital, who were willing to participate as respondents, and who did not have comorbidities. Pregnant women with malnutrition and anemia were excluded.

Demographics

Key demographic characteristics of the pregnant women included maternal and paternal age (categorized as < 20 years, 20-35 years, and > 35 years), maternal and paternal education (categorized as elementary-junior high, senior high, and bachelor's degree), maternal and paternal occupation (categorized as private employees, entrepreneurs, and civil servants), parity status (categorized as primigravida, multigravida, and grandemultigravida), antenatal care visits (categorized as non-routine and routine), family monthly income (categorized as <2,000,000 IDR, 2,000,000-5,000,000 IDR, > 5,000,000-7,000,000 IDR, and > 7,000,000 IDR), and the role of health workers and family (categorized as less optimal and optimal).

Research instrument

Data on the characteristics of pregnant women were collected using a questionnaire that included information on maternal age, paternal age, parity, maternal education, paternal education, maternal employment, paternal employment, family monthly income, and antenatal care visits. The role of health workers was assessed using 20 questions, family roles with 20 questions and CGOL consumption with 20 questions. The Likert scale was employed to measure responses, offering four choices: always, often, rarely, and never. COVID-19 confirmation data were obtained from patient medical records at both hospitals.

Statistical analysis

Statistical analysis encompassed univariate and bivariate techniques. Univariate analysis was used to describe the categorical characteristics of respondents by providing frequency distributions. Bivariate analysis aimed to explore the relationship between CGOL consumption and confirmed COVID-19 cases on pregnant women with Spearman Rho analyses were utilized with a significance level set at 5% (0.05).

Results

The characteristics of pregnant women can be found in Table 1, which includes a total of 250 respondents. It can be inferred that the majority of mothers are aged 20-35 years, with a total of 160 respondents (64%). Most fathers are aged 20-40 years, with a total of 147 respondents (58.8%). The majority of parity status is multiparous, with a total of 166 respondents (66.4%). For mothers' education, most have completed senior high school, with 132 respondents (52.8%), and fathers' education also predominantly falls under the senior high school category, with 168 respondents (67.2%). Regarding occupation, the majority of mothers were housewife with 110 respondents (44%), and the smallest category is Civil Servants, with only 25 respondents (10%). Fathers mostly work as entrepreneurs, with 153 respondents (61.2%). The highest family income within a month falls between IDR 2,000,000 - IDR 5,000,000 or equal to 130.55 USD - 326.37 USD, with 115 respondents (46%). Antenatal care visits, as seen in Table 1, are mostly done routine, with 187 respondents (74.8%), and non-routine by 63 respondents (25.2%).

Table 1. Frequency distribution of general characteristics of pregnant women (n = 250).

Variable	Quantity	Percentage
Mothers' age		
<20 years old	35	14.0
20-35 years old	160	64.0
>35 years old	55	22.0
Fathers' age		
<20 years old	8	3.2
20-40 years old	147	58.8
>40 years old	95	38.0
Parity status		
Primigravida	75	30.0
Multigravida	166	66.4
Grandemultigravida	9	3.6
Mothers' education		
Elementary-junior high school	88	35.2
Senior high school	132	52.8
University level	30	12.0
Fathers' education		
Elementary-junior high school	43	17.2
Senior high school	168	67.2
University level	39	15.6
Mothers' occupation		
Housewife	110	44.0
Private employees	57	22.8
Entrepreneur	58	23.2
Civil servants	25	10.0
Fathers' occupation		
Private employees	70	28.0
Entrepreneur	153	61.2
Civil servants	27	10.8
Family income within a month (IDR/ USD)		
< 2.000.000 / > 130.55	75	30.0
2.000.000-5.000.000 / 130.55-326.37	115	46.0
> 5.000.000-7.500.000 / >326.37-489.56	35	14.0
> 7.500.000/ > 489.56	25	10.0
Antenatal Care Visit		
Non-routine	63	25.2
Routine	187	74.8

Data on the role of health workers, family, CGOL consumption and confirmed cases of COVID-19 on pregnant woman are shown in Table 2. The role of health workers and family in pregnant women are mostly optimal, with 175 respondents (70%) and 162 respondents (64.8%), respectively. The majority of CGOL consumption is optimal, with 127 respondents (50.8%). Most pregnant women have never been confirmed positive for COVID-19, with 225 respondents (90%). Bivariate analysis was carried out using Spearman Rho as shown in Table 3. There is a relationship between CGOL consumption and confirmed COVID-19 cases with a p value of 0.0001, with a correlation coefficient of 0.647, which means there is a strong relationship.

Discussion

One of the key strategies for maintaining the health of pregnant women is optimizing their nutrition. The nutritional needs of pregnant women, both for the mother and the fetus, are critical.^{12,20} Previous research has suggested that the consumption of foods rich in certain ingredients, such as green vegetables, vitamin C-rich oranges, ginger, and lemongrass, can effectively boost immunity.^{21,22} Our results indicate that the roles of health workers and families in preventing COVID-19 and illnesses in pregnant women were largely optimal. Families play a crucial role in providing essential support to pregnant women during the perinatal period, which includes pregnancy, childbirth, and the postpartum period. Their active involvement is facilitated by daily interactions and a strong sense of responsibility for the well-being of pregnant women.^{20,23} This family support is vital for preparing pregnant women mentally and emotionally to adapt to the challenges of pregnancy.^{3,24}

Table 2. Frequency distribution of the role of health workers and family, CGOL consumption, and case of COVID-19 on pregnant women (n=250).

Variable	Quantity	Percentage
The role of health workers		
Less optimal	75	30.0
Optimal	175	70.0
The role of family		
Less optimal	88	35.2
Optimal	162	64.8
CGOL consumption		
Less optimal	70	28.0
Average	53	21.2
Optimal	127	50.8
Confirmed COVID-19 cases		
Confirmed	25	10.0
Not confirmed	225	90.0

Table 3. Bivariate analysis of the relationship between CGOL consumption and confirmed COVID-19 cases on pregnant women (n=250).

Variable	Correlation coefficient	p-value
CGOL Consumption		
Confirmed COVID-19 Case	0.647**	0.0001

(**) strong relationship.

Additionally, our findings suggest that the role of health workers was predominantly optimal, with a focus on education and health promotion, often provided during antenatal care visits. Timely initiation of antenatal care is influenced by various factors, including maternal age, education level, and socioeconomic status.¹ Non-routine attendance, often related to delayed first visits, can pose risks to maternal and fetal health.² Also stated that both rural and suburban women had a high percentage of a late first ANC visit.² These findings align with the impact of the COVID-19 pandemic on the mental health of pregnant women, as it has added stress and uncertainty to an already challenging period.^{25,26}

In terms of nutritional behavior, the majority of pregnant women exhibited optimal consumption of CGOL-rich foods. This suggests that many pregnant women include CGOL in their diets, which can be considered a safe and healthy practice.²⁷ These foods, such as green vegetables with chlorophyll, ginger with its numerous health benefits,^{15,28,29} vitamin C-rich oranges, and lemongrass containing essential oils and other nutrients, contribute to overall well-being.^{16,21,22} The antioxidant and anti-inflammatory properties of gingerol compounds in ginger, for example, can positively impact health.^{30,31,32}

Regarding specific health variables, 90% of the respondents tested negative for COVID-19, while 10% confirmed positive cases. This highlights the susceptibility of pregnant women to respiratory infections, including COVID-19, due to physiological changes and weakened immunity during pregnancy.^{4,6} However, it is important to address the stress and mental health challenges that pregnant women face during the pandemic to protect their well-being. Factors such as maternal age, education level, and socioeconomic status can influence health behaviors and outcomes. Additionally, maintaining optimal health behaviors during pregnancy positively impacts overall health, especially during the pandemic.^{31,33,34,35} A study indicated that pregnant women are more susceptible to contracting COVID-19 due to potential weakening of their immune systems.⁹ COVID-19 is characterized by immune-related factors such as reduced lymphocyte levels and elevated proinflammatory cytokines.³⁶ Pregnant women and their fetuses represent a high-risk population during infectious disease outbreaks.³⁶ Furthermore, pregnancies complicated by SARS-CoV-2 infection are associated with an increased likelihood of cesarean delivery and preterm birth.¹⁰ The emergence of new mutations in the coronavirus presents unique challenges to the medical community, as the optimal treatment approach has not yet been determined and often relies on institutional guidelines.³⁷

Several previous studies have explored the relationship between the consumption of nutrients containing CGOL and preventive efforts against COVID-19 in pregnant women. These studies have emphasized the importance of a balanced diet or nutritional therapy as a powerful strategy to combat COVID-19.¹⁴ Research findings have indicated that around 10.5% of the population, equivalent to approximately 4.6 million adults in South Korea, falls into the high-risk category, with about 20% of them having inadequate intakes of vitamins A, B1, B2, B3, and C.¹¹ While good nutrition, in general, is crucial for recovery from COVID-19 and other serious infections, specific nutrients can be particularly beneficial.¹³ Other studies have suggested that better nutrition and supplementation with various nutrients, such as omega-3 fatty acids, amino acids, zinc, and vitamins C and E, may be helpful in preventing and treating COVID-19 and other serious infections.¹⁶

In line with the aforementioned explanations, vitamin C plays a crucial role in enhancing the body's immunity, which includes protection against COVID-19.²² Oranges are an excellent example of a fruit rich in vitamin C. Furthermore, the consumption of nutri-

ents containing chlorophyll, ginger, and lemongrass is equally important in boosting immunity.^{31,32}

Conclusions

CGOL consumption is associated with the prevention of COVID-19 cases on pregnant women. Nurses can play a pivotal role in educating pregnant women about the importance of incorporating CGOL into their daily nutritional intake. Furthermore, integrating CGOL-based nutritional guidelines into prenatal care programs, especially during pandemics, can be a proactive approach to enhancing the health and immunity of pregnant women.

References

1. Manyeh AK, Amu A, Williams J, Gyapong M. Factors associated with the timing of antenatal clinic attendance among first-time mothers in rural southern Ghana. *BMC Pregnancy Childbirth* 2020;20:1-7.
2. Ebonwu J, Mumbauer A, Uys M, et al. Determinants of late antenatal care presentation in rural and peri-urban communities in South Africa: A cross-sectional study. *PLoS One* 2018;13:1-16.
3. Hawkins M, Misra D, Zhang L, et al. Family involvement in pregnancy and psychological health among pregnant Black women. *Arch Psychiatr Nurs* 2021;35:42-8.
4. Khoury JE, Atkinson L, Bennett T, et al. COVID-19 and mental health during pregnancy: The importance of cognitive appraisal and social support. *J Affect Disord* 2021;282:1161-9.
5. Efendi F, Israfil I, Ramadhan K, et al. Factors associated with receiving iron supplements during pregnancy among women in Indonesia. *Electron J Gen Med* 2023;20(5).
6. Salma U. Relationship of COVID-19 with pregnancy. *Taiwan J Obstet Gynecol* 2021;60:405-11.
7. Efendi F, Haryanto J, Has EMM, et al. Determinants of mortality risk among Indonesian patients with COVID-19. *F1000Research* 2023;11:814.
8. Moore KM, Suthar MS. Comprehensive analysis of COVID-19 during pregnancy. *Biochem Biophys Res Commun* 2021;538:180-6.
9. Phoswa WN, Khaliq OP. Is pregnancy a risk factor of COVID-19? *Eur J Obstet Gynecol Reprod Biol* 2020;252:605-9.
10. Joseph NT, Rasmussen SA, Jamieson DJ. The effects of COVID-19 on pregnancy and implications for reproductive medicine. *Fertil Steril* 2021;115:824-30.
11. Baik I. Region-specific COVID-19 risk scores and nutritional status of a high-risk population based on individual vulnerability assessment in the national survey data. *Clin Nutr* 2022;41:3100-5.
12. Armini NKA, Hidayati N, Kusumaningrum T. Determinants of Nutritional Status Among Pregnant Women: a Transcultural Nursing Approach. *J Ners* 2020;15:214-21.
13. Curtis L. Good nutrition critical to prevent Covid 19 mortality. *Hear Lung* 2021;50:441.
14. Alam S, Bhuiyan FR, Emon TH, Hasan M. Prospects of nutritional interventions in the care of COVID-19 patients. *Heliyon* 2021;7:e06285.
15. Abdullahi A, Khairulmazmi A, Yasmeen S, et al. Phytochemical profiling and antimicrobial activity of ginger (*Zingiber officinale*) essential oils against important phytopathogens. *Arab J Chem* 2020;13:8012-25.
16. Richa R, Kohli D, Vishwakarma D, et al. Citrus fruit: Classification, value addition, nutritional and medicinal values, and relation with pandemic and hidden hunger. *J Agric Food Res* 2023;14:100718.
17. Kementerian Kesehatan Republik Indonesia. Pedoman Pelayanan Antenatal, Persalinan, Nifas, Dan Bayi Baru Lahir Di Era Adaptasi Kebiasaan Baru. Kementerian Kesehatan Republik Indonesia Dirjen Kesehatan Masyarakat; 2020.
18. Dinas Kesehatan Kabupaten Jember. Survei Data Kesehatan AKI dan AKB di kabupaten Jember. 2018.
19. Dinas Kesehatan Kabupaten Jember. Survei Data Kesehatan di Kabupaten Jember. 2020.
20. Yani LY, Merbawani R, Munfadlila AW. Empowering Health Cadres on Nutrition Education for Pregnant Women in Industrial Areas during the Pandemic. *J Ners* 2021;16:177-82.
21. Sánchez-Martínez JD, Cifuentes A, Valdés A. Omics approaches to investigate the neuroprotective capacity of a Citrus sinensis (sweet orange) extract in a Caenorhabditis elegans Alzheimer's model. *Food Res Int* 2023;172.
22. Almuhayawi MS, Al Jaouni SK, Almuhayawi SM, et al. Elevated CO2 improves the nutritive value, antibacterial, anti-inflammatory, antioxidant and hypocholesterolemic activities of lemongrass sprouts. *Food Chem* 2021;357:129730.
23. Triharini M, Sulistyono A, Adriani M, Devy SR. The Effect of Health Promotion Intervention on Anemia Prevention Behavior and Haemoglobin Level in Pregnant Women: Based on Health Promotion Model and Self-Determination Theory. *J Ners* 2019;14:92-100.
24. Liang H, Acharya G. Novel corona virus disease (COVID 19) in pregnancy: What clinical recommendations to follow? *Acta Obstet Gynecol Scand* 2020;99:439-42.
25. Ibragimov U, Beane S, Friedman SR, et al. Evidence for HIV transmission across key populations: a longitudinal analysis of HIV and AIDS rates among Black people who inject drugs and Black heterosexuals in 84 large U.S. metropolitan areas, 2008-2016. *Ann Epidemiol* 2021;55:69-77.e5.
26. Hall S, White A, Ballas J, et al. Education in Trauma-Informed Care in Maternity Settings Can Promote Mental Health During the COVID-19 Pandemic. *J Obstet Gynecol Neonatal Nurs* 2021;50:340-51.
27. Swain SS, Paidesetty SK, Padhy RN, Hussain T. Nano-technology platforms to increase the antibacterial drug suitability of essential oils: A drug prospective assessment. *OpenNano* 2023;9:100115.
28. Kim J, Kim H, Beuchat LR, Ryu JH. Synergistic antimicrobial activities of plant essential oils against *Listeria monocytogenes* in organic tomato juice. *Food Control* 2021;125:108000.
29. Spence C. Ginger: The pungent spice. *Int J Gastron Food Sci* 2023;33:100793.
30. Owusu-Ansah P, Alhassan AR, Ayamgama AA, et al. Phytochemical analysis, enumeration, isolation, and antimicrobial activity of lemongrass and moringa leaves extracts. *J Agric Food Res* 2023;12:100579.
31. Balakrishnan B, Paramasivam S, Arulkumar A. Evaluation of the lemongrass plant (*Cymbopogon citratus*) extracted in different solvents for antioxidant and antibacterial activity against human pathogens. *Asian Pacific J Trop Dis*. 2014;4:134-9.
32. Martins W da S, de Araújo JSF, Feitosa BF, et al. Lemongrass (*Cymbopogon citratus* DC. Stapf) essential oil microparticles: Development, characterization, and antioxidant potential. *Food Chem* 2021;355.

33. Ryan LM, Mahmood DMA, Laurence PCO. Incidence of concomitant illnesses in pregnancy in Indonesia: Estimates from 1990-2019, with projections to 2030. *Lancet Reg Heal - West Pacific* 2021;10:100139.
34. Dawood FS, Kittikraisak W, Patel A, et al. Incidence of influenza during pregnancy and association with pregnancy and perinatal outcomes in three middle-income countries: a multisite prospective longitudinal cohort study. *Lancet Infect Dis* 2021;21:97-106.
35. Chilaka VN, Konje JC. Viral Hepatitis in pregnancy. *Eur J Obstet Gynecol Reprod Biol* 2021;256:287-96.
36. Dashraath P, Wong JJJ, Lim MXK, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. *Am J Obstet Gynecol* 2020;222:521-31.
37. Syeda S, Baptiste C, Breslin N, et al. The clinical course of COVID in pregnancy. *Semin Perinatol* 2020;44:151284.

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